

REMARKS

Status of Claims

Claims 1, 2, 5-18, 21-22, 25-27, 30-3-38 are currently pending, with claims 1, 25 and 32 being independent. Claims 1, 2, 6, 21, 22, 25, 26, 30, 32, 35, 35, and 37 have been amended to even more clearly recite and distinctly claim particularly preferred embodiments of the present invention. Support for the amendments can be found throughout the specification including, for example, in paragraphs 46, paragraphs 72-74, and paragraphs 98-100. Accordingly, no new matter has been added.

Applicants respectfully request the Examiner to reconsider and withdraw the outstanding rejections in view of the foregoing amendments and the following remarks.

Claim Rejections Under 35 U.S.C. § 103(a)

Claims 1, 2, 5-18, 21, 25-27, 30-31 and 34-38 stand rejected under 35 U.S.C. § 103(a) as allegedly unpatentable over U.S. Patent No. 2,877,257 (“Cain”) in view of U.S. Publication No. 2002/0173556 (“Moore”). Claim 22 stands rejected under 35 U.S.C. § 103(a) as allegedly unpatentable over Cain in view of Moore and further in view of U.S. Patent No. 6,476,086 (“Zhou”). Claims 32 and 33 stand rejected under 35 U.S.C. § 103(a) as allegedly unpatentable over Cain in view of Moore et al. and further in view of Zhou.

Applicants respectfully disagree with these rejections; therefore, the rejections are traversed.

Applicants note that independent claims 1, 25, and 32 have been amended to specify that it is a Fischer Tropsch derived *waxy paraffinic product stream* that is being treated in the presently claimed method. Applicants respectfully submit that the nature of the stream being treated in the presently claimed methods is significantly different from the steam in Cain.

Applicants note that Fischer-Tropsch syntheses produce a wide range of hydrocarbon and oxygenated products. Two factors influencing the nature of the products are the catalyst type and operating temperature. In general, operation at higher temperatures results in a lighter product spectrum than when operating at low temperatures. Applicants attach a copy of Fischer-Tropsch Technology, Studies in Surface Science and Catalysts, Vol. 152 (2004) pages 204 and 207 (hereinafter “Steynberg and Dry”) to provide information regarding what

one of skill in the art understood regarding the nature of Fischer Tropsch derived product streams.

The different nature of Fischer Tropsch derived product streams is exemplified in Table 2 on page 204 of Steynberg and Dry, which shows that a cobalt slurry FT process operating at 220 °C (428 °F) produces around 20 % C₆ material and around 46 % +350 °C (+660 °F, i.e. ±C₂₀₊) material, whereas an iron fluidized FT process operating at 340 °C (644 °F) produces around 64 % C₆ material and only around 5 % +350 °C material. It is further noteworthy that the total water soluble oxygenates produced with cobalt slurry at 220 °C is 1 %, compared to the 5 % produced with the fluidized iron at 340 °C.

Table 5 on page 207 of Steynberg and Dry provides information on the split between alkanes, alkenes, aromatics and oxygenates for various cuts using different catalysts and temperatures. It is immediately apparent that for all three catalysts and temperature conditions considered, the amount of alkanes increases as the fractions get heavier, whereas the alkenes and oxygenates decrease as the fractions get heavier, with alkene production higher than oxygenate production. Also apparent is that iron at 340 °C produces far more oxygenates and alkenes than cobalt at 220 °C. Of particular relevance in the context of the present application, is that the C₁₃ – C₁₈ cut of the cobalt at 220 °C contains 5 % alkenes and low oxygenates, while the C₂₄ – C₃₅ cut lists alkenes as being low and reports no oxygenates.

Cain is concerned with the treatment of a hydrocarbon stream produced when employing a fluidized iron catalyst at temperatures ranging between 550 to 700 °F (288 to 371 °C) (column 1, lines 26-36, column 5, lines 14-15). Cain discloses that the hydrocarbon stream contains between 10 and 30 % of organic chemicals such as acids, alcohols, ketones, aldehydes, esters, etc. (i.e. oxygenates) (column 1, lines 36-39). It follows from Table I (column 1, lines 40 to 45) of Example 1 that the content of acids, alcohols, and carbonyls of the hydrocarbon oil amounts to 28 %. The process of Cain is thus similar to the fluidized iron at 340 °C for which data is provided in Steynberg and Dry.

In fluidized processes, as taught in Cain, there is no continuous liquid phase within the reactor and the reactor operates as a two-phase gas-solid process. The result is that all products formed exit the reactor with this gaseous phase (i.e. there is no liquid phase product withdrawn from the reactor). The dissolved or occluded metal contaminants, such as iron or iron compounds, considered in Cain are, therefore, withdrawn together with the gaseous phase which exits the reactor.

In contrast with Cain, the independent claims as amended specify that the hydrocarbon stream to be treated is a *waxy paraffinic product stream* produced in a slurry type reactor using a catalyst comprising cobalt at a temperature between 400 and 550 °F (204 and 288 °C). A slurry type reactor operates as a three-phase gas-liquid-solid process and produces both products that are gaseous and liquid at the reactor operating conditions (paragraph 53, paragraph 79 and paragraph 98). Accordingly, there is a vapor product stream and also a liquid product stream leaving the reactor. The vapor stream is predominantly the lighter products, while the liquid stream is predominantly waxy (C₂₀₊). Claims 1, 25, and 32 are concerned with the treatment of this predominantly waxy liquid stream withdrawn from the reactor.

It follows from the discussion of Steynberg and Dry as described above that this predominantly waxy liquid stream forming the subject of the present claims has low olefin and oxygenate content, appreciably lower than what is considered in Cain. In the Office Action of 16 February 2010, the Examiner correctly points out that both Moore and the present application disclose the presence of oxygenates and olefins in the streams produced using slurry cobalt on alumina catalyzed Fischer-Tropsch processes. The data from Steynberg and Dry also support the presence of oxygenates and olefins in such streams. However, oxygenates and olefins are present in the lighter fractions produced using such slurry cobalt processes and not in the waxy paraffinic stream that is the subject of the presently claimed method.

The presently claimed method relates to contamination withdrawn from the slurry reactor together with the *liquid phase*. The present application states that prior art processes utilizing filtration (usually capable of removing particles down to 1 micron in size) is not effective at removing the contamination (paragraph 12). In addition, the contamination may still be present when the hydrocarbon stream is filtered to remove particles larger than about 0.1 microns (paragraph 42). It is believed that the contamination may comprise aluminum metal present in a complex organic matrix consisting of at least one or more organic components (paragraph 77).

The present invention is thus concerned with the problem of removal of contamination comprising aluminum metal present in a complex organic matrix from a *waxy paraffinic product stream* withdrawn in liquid form from a slurry reactor.

In contrast, Cain is concerned with the removal of dissolved or occluded iron or iron compounds from a hydrocarbon stream containing between 10 and 30 % oxygenates that is withdrawn together with the gaseous phase from a fluidized bed reactor. It is respectfully submitted that a skilled person faced with the difficulty of removing contamination comprising aluminum metal present in a complex organic matrix from a waxy paraffinic product stream withdrawn in liquid form from a slurry reactor, will have no incentive to consider the teaching of Cain. None of the other prior art documents of record remedies this defect.

Similar reasoning applies in respect of claims 1, 25 and 32, all of which have been amended to include the features further distinguishing the cited prior art.

Specifically with regard to the rejection of claim 22, Applicants provide the following additional comments.

As described above, Cain does not disclose or suggest a method for removing contamination from a *Fischer-Tropsch derived waxy paraffinic product*. As discussed above, Cain relates to a process for the purification of *hydrocarbon solutions of oxygenated organic compounds* comprising acids. Accordingly, the product stream of the presently claimed process and the product stream of Cain are significantly different. Therefore, Applicants respectfully submit that one of skill in the art would not look to Cain for guidance when faced with the problem of removing Al contamination from a paraffinic stream.

Moore is merely cited for the propositions that Fischer-Tropsch streams are produced in processes that utilize catalysts such as iron or cobalt catalysts and that Fischer-Tropsch derived streams may be fractionated (i.e. distilled) and hydrotreated.

Cain in view of Moore does not disclose or suggest a method for removing contamination from a *Fischer-Tropsch derived waxy paraffinic product*. Cain in view of Moore does not disclose or suggest removing *Al contamination in particulate form*. Moreover, Applicants respectfully submit that Cain in view of Moore does not disclose or suggest filtering the at least one acidic extracted Fischer-Tropsch derived hydrocarbon stream to remove at least a portion of the Al contamination in particulate form.

Zhou is cited merely as disclosing using a surfactant and disclosing filtration techniques to separate solid contaminants.

As cited, Zhou does not correct the many above-noted deficiencies of Cain in view of Moore.

Specifically with regard to the rejection of claims 32 and 33, Applicants provide the following additional comments.

As described above, Cain relates to a process for the purification of hydrocarbon solutions of *oxygenated organic compounds comprising acids* and which also may contain dissolved or occluded metal contaminants such as iron or iron compounds.

Also as described above, Moore is cited as disclosing that Fischer Tropsch streams are produced in processes that utilize iron or cobalt catalysts. Moore is also cited as disclosing “that F-T derived streams may be fractionated (i.e., distilled) and hydrotreated.”

Zhou relates to a method for separating iron-based catalyst fines from hydrocarbon liquid/wax/catalyst slurry for Fischer-Tropsch synthesis processes by contacting and/or mixing the slurry with a coalescence enhancing treating solution to facilitate gravity separation and settling of such catalyst, and thereby yield a substantially clean hydrocarbon liquid/wax product. (Abstract). Zhou discloses that the treating solution includes a surface tension reducing agent, an agglutinating agent, and a coalescing agent, each in selected proportions in aqueous solution. (Abstract). Zhou is cited as disclosing filtration techniques used to separate solid contaminants from Fischer Tropsch derived streams.

As described above, the presently claimed process is significantly different than the process of Cain and one of skill in the art would not merely combine process features of Moore with Cain.

Moreover, it is respectfully maintained that in no way does Cain, Moore, or Zhou disclose or suggest providing an additive to the contents of the Fischer-Tropsch reactor to precipitate soluble contamination within the reactor. Applicants note that the Examiner asserts that it would have been obvious to one having ordinary skill in the art to have modified the process of Cain by adding the acid to the reactor because the same purification would take place with the added benefit of cost savings due to the reduced equipment requirement.

Applicants maintain that it would not be practical or of added benefit to add a water solution of acetic acid to the Fischer Tropsch reactor. Fischer Tropsch reactions are conducted at temperatures of 400 – 550 °F, as presently claimed. A water solution would

significantly cool the reactor causing the reactor to need to be reheated to reaction temperature to conduct Fischer Tropsch reactions. Furthermore, a water solution would evaporate at the reaction temperatures, and thus, could not be used to extract the product inside the reactor, unless first the reactor was cooled significantly and then heated again to reaction temperature. All of these possibilities for using the water solution in the reactor would not be practical or of added benefit, if possible at all.

Therefore, for at least the above reasons, Applicants request that the § 103(a) rejections be withdrawn.

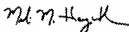
Conclusion

For the reasons noted above, the art of record does not disclose or suggest the inventive concept of the present methods as defined by the claims.

In view of the foregoing amendments and remarks, reconsideration of the claims and allowance of the subject application is earnestly solicited. In the event that there are any questions relating to this application, it would be appreciated if the Examiner could telephone the undersigned attorney concerning such arguments so that prosecution of this application may be expedited.

If necessary for a timely response, this paper should be considered as a petition for an Extension of Time, and please charge any deficiency in fees or credit any overpayments to Deposit Account No. 05-1323 (Docket #70212.0001US01).

Respectfully submitted,



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